

Pinellas Environmental Restoration Project: Groundwater Remediation at the 4.5 Acre Site at the Young-Rainey STAR Center, Largo, Florida

The U.S. Department of Energy (DOE) is performing ongoing remediation of contaminated groundwater at the 4.5 Acre Site adjacent to the Young-Rainey Science, Technology, and Research (STAR) Center. Remediation is being performed using biosparging, a method that injects air into the groundwater to enhance the breakdown of contamination by microorganisms that naturally exist in that environment. This cleanup is being conducted as part of the Pinellas Environmental Restoration Project that is managed by the DOE Grand Junction Office.

Background

The 4.5 Acre Site was formerly a part of the U.S. Department of Energy (DOE) facility located in Largo, Florida, now known as the Young-Rainey Science, Technology, and Research (STAR) Center (Figure 1). The 4.5 Acre Site was sold to a private landowner in 1972. DOE is currently leasing the 4.5 Acre Site while groundwater remediation is ongoing.

During the period of DOE ownership, the 4.5 Acre Site was used for disposal of drums containing waste resins and solvents that resulted in contamination of the groundwater in the sandy, shallow surficial aquifer. The major contaminants, based on toxicities and concentrations, are benzene, dichloroethene, trichloroethene, and vinyl chloride. The drums and the contaminated soil were removed in 1985.

Remediation Activities

In 1990, a groundwater extraction and treatment system was put into operation at the 4.5 Acre Site. Contaminated groundwater at the 4.5 Acre Site was extracted through seven recovery wells. The extracted water was treated with an air stripper to remove the volatile organic compounds, and the treated water was discharged to a publicly owned water treatment system. This treatment reduced the contaminant plume and contained it within the boundaries of the site. By 1997, however, concentrations of contaminants in the surficial

aquifer were no longer being effectively reduced by extraction and treatment with the air stripper.

A dual-phase extraction system was installed at the 4.5 Acre Site in 1997 to replace the groundwater-extraction system. The dual-phase system consisted of a vacuum pump linked to 22 extraction wells. The dual-phase aspect of the system referred to the capability of the system to recover both water and vapor (two carriers of the contamination) from the subsurface. The dual-phase system was an improvement in comparison with the groundwater-extraction system because it used a vacuum to help move the groundwater and recover vapor from subsurface areas not reached by the groundwater-extraction system. By the end of 1998, the dual-phase system had treated approximately 9.45 million gallons of contaminated groundwater. This system was effective at removing high concentrations of contaminants, but it became less effective as contaminant concentrations decreased.

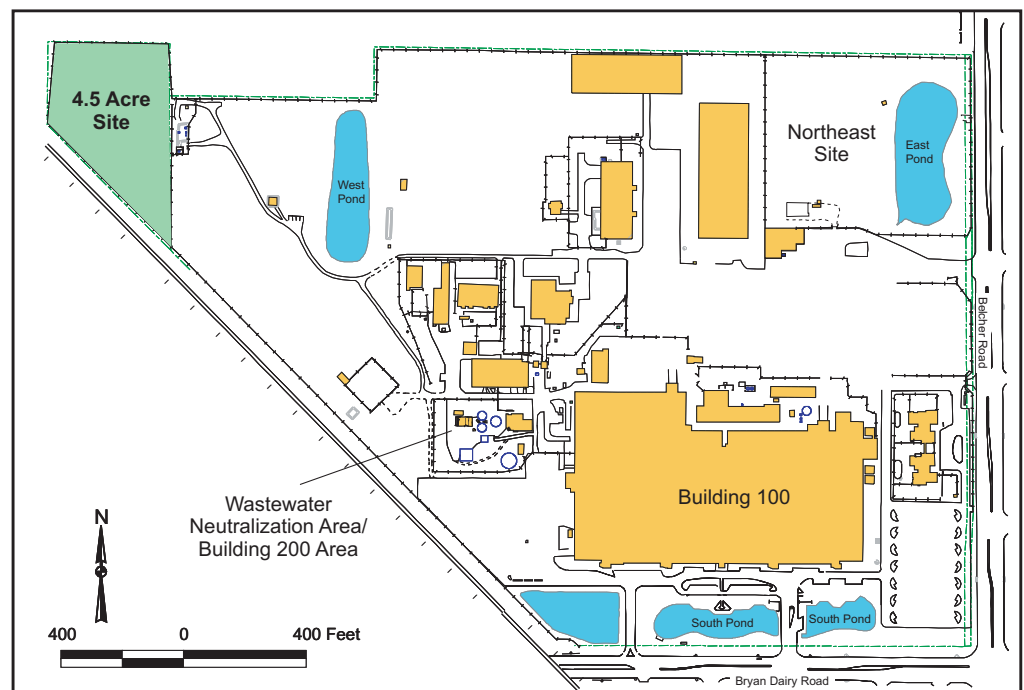


Figure 1. Location of 4.5 Acre Site

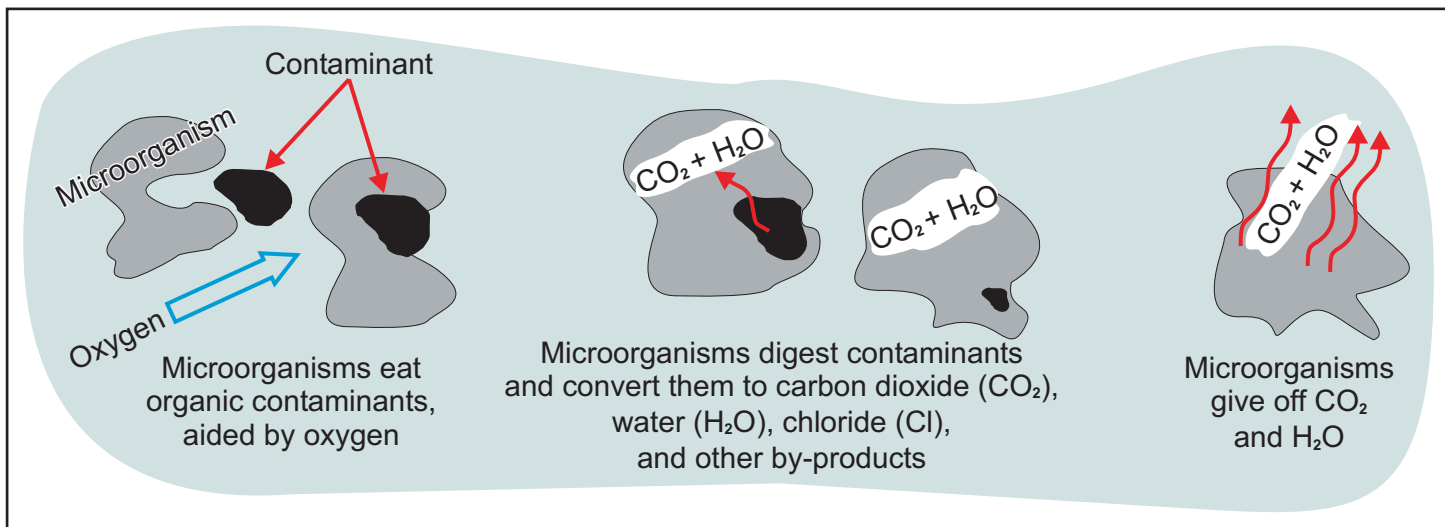


Figure 2. Generalized aerobic bioremediation process

DOE evaluated additional technologies to complete groundwater remediation at the 4.5 Acre Site and selected a type of enhanced bioremediation called biosparging. Bioremediation helps naturally occurring subsurface microorganisms break down organic compounds to the harmless components carbon dioxide and water.

A biosparging system was installed at the 4.5 Acre Site in late 1998 to enhance aerobic bioremediation. Aerobic bioremediation takes place in the presence of oxygen (Figure 2). The system injects air into the subsurface; the air passes through the groundwater and provides an oxygen-rich environment for the aerobic microorganisms, increasing their ability to break down organic compounds that contaminate the site.

The biosparge injection system consists of 3 horizontal wells that are approximately 24 feet below ground level for a length of approximately 500 feet. The area below ground level consists of a pipe with rectangular slots (screens) for air to pass through. Rotary blowers are used to push air through the system and into the subsurface. Figure 3 presents a cross-sectional schematic of a horizontal well.

To ensure correct operation of the biosparge system and provide oxygen as uniformly as possible to the

subsurface, the recovery wells at the 4.5 Acre Site were abandoned and sealed to prevent the injected air from using the wells as pathways to the ground surface. Wells outside the area of influence of the biosparging system were left in place.

Current Activities

As of September 2002, contamination in the groundwater at the 4.5 Acre Site has been reduced and confined to the site. To evaluate the effectiveness of the treatment, groundwater sampling and analyses of samples are performed quarterly. Before sampling, the biosparge system is shut down to allow the groundwater to stabilize. Samples are collected from monitor wells and from direct-push temporary well points (Figure 4). The direct-push locations are used within the area of influence of the biosparging system to avoid short circuiting the escape of air from the subsurface. Direct-push sampling is conducted by hydraulically punching a hollow drill rod into the soil. When the desired depth is reached, the rod is pulled up slightly, exposing a slotted sleeve and allowing groundwater to flow into the rod. A sample of the groundwater is collected from inside the rod with a pump and tubing. All direct-push locations are sampled at a target depth of 30 feet below ground surface.

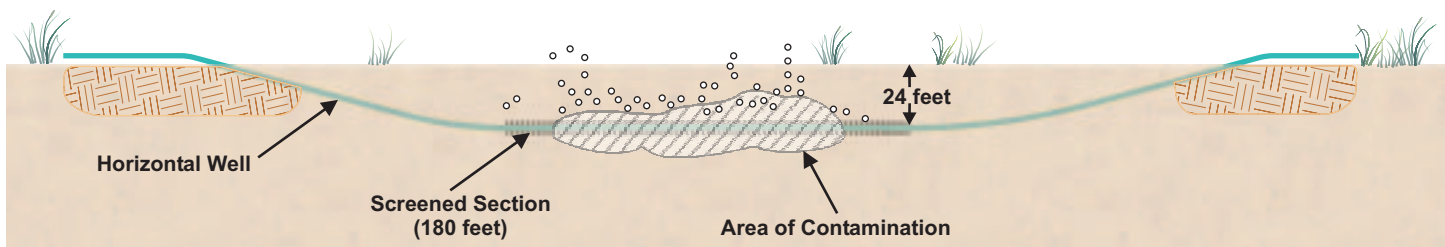


Figure 3. Horizontal well cross section (approximately 500 feet in length)

A subset of locations is also sampled at a shallower depth of 22 feet below ground surface. Groundwater samples are analyzed for volatile organic compounds. Water-level measurements and physical parameters such as dissolved oxygen and conductivity are also collected to assist in evaluating subsurface conditions. Remediation will continue until the groundwater meets the applicable federal standards for drinking water.

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Additional information and fact sheets about the Pinellas Environmental Restoration Project at the Young-Rainey STAR Center are available on the Internet at <http://www.gjo.doe.gov/Pinellas/index.htm>.

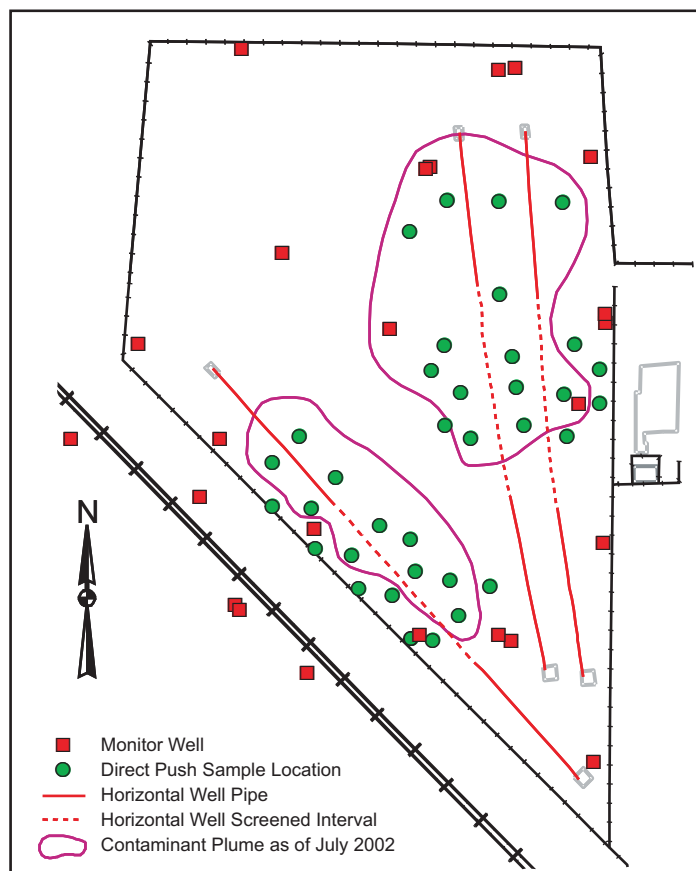


Figure 4. Locations of sample points at 4.5 Acre Site